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Dual Drug Piperine-Paclitaxel Nanoparticles Inhibit Migration and Invasion in Human Breast Cancer Cells

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Abstract : In combination therapy, two chemotherapeutic agents work together in a collaborative action. It has appeared as one of the promising approaches to improve anti-cancer treatment efficacy. In the present investigation, piperine (P-NPS), paclitaxel (PTX NPS), and a combination of both, piperine-paclitaxel nanoparticle (Pip-PTX NPS), were made by the nanoprecipitation method and later characterized by PSA, DSC, SEM, TEM, and FTIR. All nanoparticles exhibited a monodispersed size distribution with a size of below 200 nm, zeta potential ranges from (-30-40mV) and a narrow polydispersity index (>0.3) of the drugs. The average encapsulation efficiency was found to be between 80 and 90%. In vitro release of drugs for nanoparticles was done spectrophotometrically. FTIR and DSC results confirmed the presence of the drug. The Pip-PTX NPS significantly inhibit cell proliferation as compared to the native drugs nanoparticles in the breast cancer cell line MCF-7. In addition, Pip-PTX NPS suppresses cells in colony formation and soft gel agar assay. Scratch migration and Transwell chamber invasion assays revealed that combined nanoparticles reduce the migration and invasion of breast cancer cells. Morphological studies showed that Pip-PTX NPS penetrates the cells and induces apoptosis, which was further confirmed by DNA fragmentation, SEM, and western blot analysis. Taken together, Pip-PTX NPS inhibits cell proliferation, anchorage dependent and anchorage independent cell growth, reduces migration and invasion, and induces apoptosis in cells. These findings support that combination therapy using Pip-PTX NPS represents a potential approach and could be helpful in the future for breast cancer therapy.

Keywords : piperine, paclitaxel, breast cancer, apoptosis
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